



2013 Washington State Enhanced State Hazard Mitigation Plan

Best Available Science Guidance

This appendix provides some examples of Best Available Science to use for hazard mitigation planning. It is not an exhaustive list.

The Washington State Department of Commerce adopted administrative rules in August 2000 (Washington Administrative Code 365-195-900 through 925) to assist cities and counties in determining what is the best available science, where to obtain it, how to include it in land use management policies and regulations, and what to do if there is no available valid scientific information. Scientific information can be produced only through a valid scientific process. To ensure that the best available science is being included in policies and regulations, a county or city should consider the “characteristics” of a valid scientific process and common sources of scientific information [see WAC Chapter 365-195-905(5)].

In the context of critical areas protection, a valid scientific process is one that produces reliable information useful in understanding the consequences of a local government’s regulatory decisions. Chapter 365-195-905(2) WAC states that the Department of Commerce will make available a list of resources that state agencies have identified as meeting the characteristics of the best available science. Commerce produced the [GMS Guidebook: Citations of Recommended Sources of Best Available Science \(BAS\) – For Designating and Protecting Critical Areas](#) in 2002. As science is a dynamic process and new science and new interpretation of existing work occur continually, it is impossible to present all of the science in a single source that may be appropriate for use in decision-making and plan development. Nonetheless, its 95 pages remains the standard.

The forthcoming summer 2013 release of the State Hazard Mitigation Handbook, State Hazard Mitigation Tool Guide, and State Hazard Mitigation Handbook Appendices, specifically Element B for Hazard Identification and Risk Assessment, provides an extensive table of mostly federal or national data sources similar but not necessarily duplicative of the ones listed below.

The sources provided below are but a sampling of information available for use by local jurisdictions as they develop their hazard mitigation plans. The State used these sources in the development of its SHMP. There are many open-sources of data available, but peer reviewed science are validated studies. Open source data may not be. The intent behind mitigation planning is not to make the jurisdictions create new information, but to utilize already existing data where gaps exist. However, if the local jurisdiction has the ability to conduct a valid study that will benefit the body of the whole, and the information is validated, local jurisdictions are encouraged to provide that data to the State for inclusion in this document.



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Generic Hazards Sites / Science

The Natural Hazards Center: funded by a consortium of federal agencies and located at the University of Colorado, the center's goal is to strengthen communication among researchers and the individuals, organizations, and agencies concerned with reducing damages caused by disasters. The website contains updated information and links to publications, organizations, and other internet resources for hazards research and practice. See www.colorado.edu/hazards/

Hazards United States (HAZUS): is FEMA's methodology for estimating potential losses from disasters. Current scientific and engineering knowledge is coupled with the latest geographic information systems (GIS) technology to produce estimates of hazard-related damage before, or after, a disaster occurs. See www.fema.gov/hazus

Washington HAZUS User Group (WAHUG): provides HAZUS support and guidance for Washington State public, private, and educational organizations interested in utilizing HAZUS for mitigation and analysis purposes. See www.usehazus.com/wahug

InteractiveNWS (iNWS): hosts mobile and desktop innovations from the National Weather Service. iNWS strives to fulfill their mission of protecting life and property by using new technology to reach out to our customers. Register and define your "Alert Area" as a county, a zip code, address, city, landmark, or custom areas defined by the user. See <http://inws.wrh.noaa.gov>

National Weather Service (NWS): provides four forecast offices to serve Washington State. These are Seattle, Spokane, Pendleton, and Portland. Their web sites offer a wealth of information that supports the four phases of emergency management - mitigation, preparedness, response, and recovery. Key web site elements include the Area Forecast Discussion, latest outlooks, watches, warnings, and advisories, climatic/historical data resources, the Advance Hydrologic Predictive Service or AHPS, and digital forecasts including GIS mapping forecast fields. See www.weather.gov

U.S. Geological Survey (USGS): The USGS is a science organization that provides impartial information on the health of our ecosystems and environment, the natural hazards that threaten us, the natural resources we rely on, the impacts of climate and land-use change, and the core science systems that help us provide timely, relevant, and useable information. The webpage *Science in Your Backyard* links directly to a multitude of sites with specific natural hazards information on the state, including real-time information. See <http://www.usgs.gov/state/default.asp>. The webpage *Natural Hazards Gateway* provides links to information on all the natural hazards. See http://www.usgs.gov/natural_hazards/

Washington State Department of Natural Resources (DNR), Geologic Information Portal: hosts interactive earth science mapping, data, and related information. See http://www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/geology_portal.aspx

Washington State Hazard Identification and Vulnerability Assessment: provides overview of hazards throughout the state. See http://www.emd.wa.gov/plans/documents/HIVA_2009_FINALformattingNOV09.pdf



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Federal Emergency Management Agency (FEMA): ideas on how to mitigate the impacts of natural hazards. See [Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards](#)

Natural Hazards

Avalanche

- Northwest Weather and Avalanche Center: promotes safety by helping reduce the impacts of avalanches and adverse mountain weather on recreation, industry and transportation in Washington, and northern Oregon through [data collection](#), [mountain weather](#) and [avalanche forecasting](#), and [education](#).. See <http://www.nwac.us/>
- Washington State Department of Transportation Avalanche Control: provides description of avalanche control activities, winter driving information, and state travel information. See <http://www.wsdot.wa.gov/maintenance/avalanche/>

Drought

- USGS Drought Watch: provides numerous links to drought specific resources. See wa.water.usgs.gov/news/drought/resources.html
- National Drought Mitigation Center: helps people and institutions develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. See <http://drought.unl.edu/>
- Washington State Department of Ecology: provides drought information during a declared drought emergency. See <http://www.ecy.wa.gov/drought/index.html>
- USDA Disaster Declarations: The Farm Service Agency provides assistance for natural disaster losses, resulting from drought, flood, fire, freeze, tornadoes, pest infestation, and other calamities. See <http://disaster.fsa.usda.gov>.

Earthquake

- USGS Earthquake Hazards Program: provides information on earthquake hazards in the Pacific Northwest region. See earthquake.usgs.gov/regional/pacnw. The program also includes ShakeMaps, which can provide near-real-time maps of ground motion and shaking intensity following significant earthquakes. See earthquake.usgs.gov/earthquakes/shakemap
- The Pacific Northwest Seismic Network: site maintained by the University of Washington and includes links to a variety of earthquake related research, data, and news. See <http://www.pnsn.org/>
- Washington State Department of Natural Resources (DNR) provides information on geologic hazards. Their geologists actively identify, assess, and map geologic hazards using modern geotechnical and geophysical methods. Our hazard maps are critical for land-use and emergency-management planning, disaster response, and building-code amendment. Additionally, there are twenty earthquake scenarios with ShakeMaps and HAZUS results in the *Washington State Earthquake Hazards Scenario Catalog*. See http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/geologic_hazards.aspx.



- Fire

- ## Flood

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- Washington State Department of Ecology Coastal Atlas: provides information about Washington's marine shorelines and the land areas near Puget Sound, the outer coast, and the estuarine portion of the Columbia River, including public access and beach closures. See Marine Spatial Planning Overview <http://www.ecy.wa.gov/programs/sea/msp/index.html>
- SeaSketch Designing for Our Oceans (<http://video.esri.com/watch/1002/designing-for-our-oceans>) is being used in New Zealand for Ocean GeoDesign Spatial Decision Making incorporating non-science stakeholders and Ocean GIS <http://video.esri.com/watch/1650/ocean-gis> mapping oceans bathymetry like topography on land for marine spatial planning.
- NOAA Coastal Services Center: provides coastal county snapshots in its Digital Coast Program. Current topics include Flood exposure, Wetland benefits, and Ocean and Great Lakes jobs. <http://www.csc.noaa.gov/digitalcoast/tools/snapshots/>. It includes StormSmart Coasts program that provides a clearinghouse for coastal decision-makers interested in accessing, applying, and sharing resilience information. The interface breaks out reports by State and County. StormSmart Coasts program

Landslide

- USGS Landslide Hazards Program: gathers information, conducts research, and produces scientific reports and other products for planners and decision makers from all government entities. The site includes a rollup of landslides reported in the media by calendar year. <http://landslides.usgs.gov/>
- Washington State Department of Natural Resources (DNR): provides landslide data. See http://www.dnr.wa.gov/BusinessPermits/Topics/LandslideHazardZonation/Pages/fp_lhz_compiled.aspx and <http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/landslides.aspx>
- Washington State Department of Natural Resources (DNR) Geological Hazards: provides information on geologic hazards. Their geologists actively identify, assess, and map geologic hazards using modern geotechnical and geophysical methods. Our hazard maps are critical for land-use and emergency-management planning, disaster response, and building-code amendment. See http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/geologic_hazards.aspx
- Washington State Department of Ecology: provides information on landslides and slope maps. See <http://www.ecy.wa.gov/programs/sea/landslides/index.html>
- USGS Circular 1325: The Landslide Handbook-A Guide to Understanding Landslides provides a synthesized summary of landslides, land-use policies, and simple precautions to ensure an individual's immediate safety. See <http://pubs.usgs.gov/circ/1325/>

Severe Storms

- National Severe Storms Laboratory: is working to improve the lead-time and accuracy of severe weather warnings and forecasts in order to save lives and reduce property damage. See www.nssl.noaa.gov



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- Storm Prediction Center: provides timely and accurate forecasts and watches for severe weather and monitors heavy rain, heavy snow, and fire weather events and issues specific products for those hazards. www.spc.noaa.gov/misc/aboutus.html
- StormReady: is a program developed by the National Weather Service designed to help cities, towns, counties, universities, and other larger sites to reduce the potential for disastrous severe storm related consequences. <http://www.stormready.noaa.gov/>
- SHELDUS: is Spatial Hazard Events and Losses Database for the United States providing data, maps and research by state and by county. Its mission is to conduct basic research on hazard vulnerability and resilience; train the next generation of hazard scientists and practitioners; and through its outreach efforts, assist in the improvement of emergency preparedness, planning, response, and recovery at local, state, national, and international scales. See <http://webra.cas.sc.edu/hvri/>

Tsunami

- TsunamiReady: a program developed by the National Weather Service designed to help cities, towns, counties, universities, and other larger sites in coastal areas reduce the potential for disastrous tsunami-related consequences. www.tsunamiready.noaa.gov
- NOAA Center for Tsunami Research: supports research and development of improved methods to predict tsunami impacts on the population and infrastructure of coastal communities. nctr.pmel.noaa.gov/index.html
- Tsunami Hazard Maps: shows the modeled tsunami inundation areas based on a Cascadia Subduction Zone Earthquake. Additionally, tsunami evacuation maps are hosted by DNR. See <http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/tsunamis.aspx>

Volcano

- USGS Volcano Hazards Program: links to a multitude of volcano related information including the Cascades Volcano Observatory. <http://volcanoes.usgs.gov/>
- Washington State Department of Natural Resources (DNR) provides information on geologic hazards. Their geologists actively identify, assess, and map geologic hazards using modern geotechnical and geophysical methods. Our hazard maps are critical for land-use and emergency-management planning, disaster response, and building-code amendment. See http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/geologic_hazards.aspx

Technological Hazards

Animal, Crop, Plant Disease, and Infestation Outbreak

- Washington State Department of Agriculture: provides a broad spectrum of activities that support the producers, distributors, and consumers of Washington's food and agricultural products. See <http://www.agr.wa.gov>



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- U.S. Department of Agriculture: provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on sound public policy, the best available science, and efficient management. See <http://www.usda.gov>

Dam Safety

- Washington State Department of Ecology – Dam Safety Office: provides emergency response services, construction services, inspection services, and coordination services for dams. See <http://www.ecy.wa.gov/programs/wr/dams/dss.html>
- US Army Corps of Engineers, National Levee Database: provides information to facilitate and link activities, such as flood risk communication, levee system evaluation for the National Flood Insurance Program (NFIP), levee system inspections, flood plain management, and risk assessments. See <http://nld.usace.army.mil/egis/f?p=471:1:0::NO>

Hazardous Materials

- Environmental Protection Agency, Emergency Planning and Community Right-to-Know Act (EPCRA): leads the national effort to prevent, prepare for, and respond to environmental emergencies. Specifically, it works with other EPA partners, federal agencies, state and local response agencies, and industry to prevent accidents, and maintain and provide superior response capabilities. See <http://www.epa.gov/emergencies/content/epcra/index.htm>
- Washington State Department of Ecology: provides information and program services for spills, toxics cleanup, and nuclear waste. See <http://www.ecy.wa.gov/cleanup.html>
- Washington State Department of Health: respond to acts of bioterrorism, outbreaks of infectious disease, and other large-scale public health emergencies or mass casualty incidents. See <http://www.doh.wa.gov/AboutUs/ProgramsandServices/OfficeoftheSecretary/PublicHealthEmergencyPreparednessandResponse>

Pipelines

- U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration: is the federal safety authority for ensuring the safe, reliable, and environmentally sound operations of our nation's pipeline transportation system. See <http://primis.phmsa.dot.gov/comm/Index.htm?nocache=7657>
- Washington Utilities and Transportation Commission, Pipeline Safety: develops and enforces safety standards for natural gas and hazardous liquid pipelines located within the state. See <http://www.utc.wa.gov/publicSafety/pipelineSafety/Pages/default.aspx>

Public Health Communicable Disease Outbreak, Epidemic, and Pandemic

- Centers for Disease Control and Prevention: is to collaborate to create the expertise, information, and tools that people and communities need to protect their health – through health promotion, prevention of disease, injury and disability, and preparedness for new health threats. See <http://www.cdc.gov/osels/phsipo/>



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- Washington State Department of Health: provides data and statistical reports, communicable disease conditions, and emergency preparedness information. See <http://www.doh.wa.gov/PublicHealthandHealthcareProviders.aspx>
- World Health Organization: provides general information, technical information, statistics, publications, and programs on infectious diseases. See http://www.who.int/topics/infectious_diseases/en/

Terrorism

- Federal Bureau of Investigation, Seattle Division: provides statistics, news, and information about counter-terrorism. See <http://seattle.fbi.gov/>
- U.S. Department of Homeland Security: provides statistics, news, and information about terrorism. See www.dhs.gov/index.shtm
- Washington State Patrol, Homeland Security Division: provides information on grants, activities, and programs related to homeland security. See www.wsp.wa.gov/crime/homeland.htm

Other

Climate Change

- Washington State Department of Ecology: provides information on climate change, policy guidance, programs, and publications. See <http://www.ecy.wa.gov/climatechange/index.htm>

Growth Management – Critical Areas

- The Department of Commerce provides a list of resources that state agencies have identified as meeting the characteristics of the best available science. See <http://www.commerce.wa.gov/Services/localgovernment/GrowthManagement/Growth-Management-Planning-Topics/Critical-Areas-and-Best-Available-Science/Pages/default.aspx> and *Citations of Recommended Sources of Best Available Science for Designating and Protecting Critical Areas*, at <http://www.commerce.wa.gov/Documents/GMS-BAS-Citations-Final.pdf>
- *Optional Natural Hazards Element for Comprehensive Plans*
<http://www.commerce.wa.gov/Documents/GMS-Natural-Hazard-Reduction.pdf>

Hazardous Materials

- Facility/Site Identification (F/SID) System - Information on facilities and sites of interest to the Department of Ecology. State Cleanup sites Federal Superfund sites, Hazardous Waste Generators, Solid Waste Facilities, Underground Storage Tanks, and Dairies Enforcement.

ShakeMaps for Washington State

- The following pages represent ShakeMaps for various scenarios throughout the state. Additional information is available at the USGS website at:
earthquake.usgs.gov/earthquakes/shakemap

Geospatial Interactive Maps



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- Washington State Department of Natural Resources: provides interactive map themes on the Geologic Information Portal. See http://www.dnr.wa.gov/Publications/ger_portal_map_themes.html#wigm



Washington Interactive Geologic Map

[[launch](#)] | [[about](#)]



Landslides of Washington State

[[launch](#)] | [[about](#)]



Tsunami Evacuation Map

[[launch](#)] | [[about](#)]



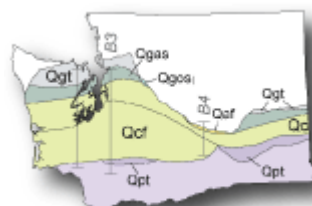
Mount Rainier Lahar (Volcanic Mudflow) Hazards - Property at Risk

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Geothermal Resources of Washington

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Subsurface Geology Information System

[[launch](#)] | [[about](#)]



Earth Resource Permit Locations

[[launch](#)] | [[about](#)]



Washington State Coal Mine Map Collection

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NEW! Seismic Scenarios Catalog

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Geospatial Maps for Washington available from other websites

- USGS National Map Viewer - A U.S. Geological Survey site that allows you to interactively view "The National Map" data as a map, customize the view, and print a map.
- USGS Earth Explorer - Allows you to search, download, and order U.S. Geological Survey products from many datasets.
- Washington State Orthoimage Portal - Allows you to view and download orthoimagery of Washington, prepared from aerial photographs and other data.
- Washington Department of Ecology GIS Applications - Access to GIS applications that the Department of Ecology uses in accomplishing its mission of protecting the land, air, and waters



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of the state. Topics include shoreline aerial photos, regulated facilities, coastal atlas, well log viewer, environmental data, and water quality information.

- DNR Forest Practices Application Review System (FPARS) - FPARS is designed to streamline the processing of Forest Practices Applications and improves the public's ability to review proposed forest activities; it can also be used for creating base maps for other purposes.

Geospatial Downloadable Data

- WSDOT GeoData Distribution Catalog - A centralized distribution site for GIS data produced at the Washington State Department of Transportation.
- Washington Department of Ecology GIS Data - Access to downloadable GIS data.

Other Earth Science Information Sources

- USGS National Geologic Map Database (NGMDB) - A U.S. Geological Survey resource for maps and related data about geology, hazards, earth resources, geophysics, geochemistry, geochronology, paleontology, and marine geology.

Planning Documents

- Natural Hazard Mitigation Association (NHMA) <http://nhma.info/> White Paper, *Planning and Building Livable, Safe & Sustainable Communities. The Patchwork Quilt Approach*. <http://nhma.info/uploads/publications/Patchwork%20Quilt%20for%202011%20Annual%20Meeting.pdf>. There are helpful web sites listed at the end of the document too!
- American Planning Association (APA) <http://www.planning.org/> *Hazard Mitigation: Integrating Best Practices into Planning*. The site has additional planning oriented products for mitigation and recovery including a bookstore <http://www.planning.org/apastore/default.aspx> and a Hazards Planning Research Center: <http://www.planning.org/nationalcenters/hazards/>.
- Federal Emergency Management Agency (FEMA) <http://www.fema.gov/plan-prepare-mitigate> provides information and links regarding mitigation and the agencies services.

Demographic Data

- U.S. Census shapefiles at <http://www.census.gov/geo/www/tiger/tgrshp2010/availability.html> and demographics at <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>.
- The Social Vulnerability Index (SoVI®) 2006-10 measures the social vulnerability of U.S. counties to environmental hazards. The index is a comparative metric that facilitates the examination of the differences in social vulnerability among counties. The index synthesizes 30 socioeconomic variables, which the research literature suggests contribute to reduction in a community's ability to prepare for, respond to, and recover from hazards. SoVI® data sources include primarily those from the U.S. Census Bureau. See <http://webra.cas.sc.edu/hvri/products/sovi.aspx> and <http://www.csc.noaa.gov/digitalcoast/data/sovi>.
- The Washington State Office of Financial Management <http://ofm.wa.gov/pop/default.asp> develops official state and local population estimates and projections for use in the allocation of certain state revenues, growth management, and other planning functions. As the official partner of the U. S. Census Bureau for Washington State, the Population unit helps disseminate information about the characteristics of Washington's population, housing, and economy and provide guidance to a variety of stakeholders in accessing and using demographic information.



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- The Washington State Employment Security Department provides data and analysis of Washington State's employment conditions, economy, job market, and work force.
<https://fortress.wa.gov/esd/employmentdata/>
- The Regional Economic Analysis Project (REAP) features data and regional economic tools of analysis that apply to the 39 Washington counties and Washington's 12 metropolitan statistical areas (MSAs). The cornerstone for the data used on REAP are the state and county level income, earnings, employment, transfer payments and product data compiled and updated annually by the Bureau of Economic Analysis, U.S. Department of Commerce
<http://www.bea.gov/regional/about.cfm>.